



Berkeley Lab Test Facility for Low-Energy Integrated Building Systems



Lighting Study Support
May 2011

Lighting Study Support:

Research Objective/Outcomes

- Improving design intent and system performance documentation that encourages innovation, stimulates competition and reduces installation costs
- Creating an accessible database of measured results from the different tested systems to help build confidence that properly specified and installed controls can save significant energy with excellent occupant acceptance.
- Performing/developing manufacturer- and technology-neutral commissioning procedures for all sensors, controllers, switches and user controls.
- Developing Guides for electrical installers that reduce wiring errors and eliminate callbacks
- Promoting integrated lighting system solution proposals from manufacturing partners of integrated controls and lighting technologies.
- Creating partnerships between utilities and large real estate owners/managers that are designed to compare different solutions from different companies on a level playing field.
- Impact of blinds/shading devices/external conditions on thermal performance of various technologies
- Impact of types and locations of interior furnishings and layouts

HVAC System Support

The test beds will include the infrastructure to support all major types of 'end use' HVAC devices needed for the specific systems being tested. The test beds are designed for quick reconfiguration to allow for cost effective experimental setups. All systems will be possible to configure separately or in any combination.

Systems supported will include but are not limited to:

Envelope System Support

- Exterior wall constructions will support a variety of types, thicknesses, glazing arrangements (window wall ratio & placement) as well as interior and exterior shading systems. Specific south facing envelope configurations can be made to suite specific experimental needs.
- Interchangeable shading systems—both internal and external.
- Instrumentation cabling for low voltage power to local shade mechanisms
 - Communication and control wiring for all systems
- Skylighting access for reconfigurable skylight testing
 - Louver systems
 - Shading systems
 - Combo skylight / electric lights

- Ceilings will support hung, cloud, and open configurations (including radiant panels)

Lighting System Support

LBNL aims to provide a virtual foundry where innovative lighting control solutions can be installed, tested, measured and refined so that the industry acquires the ability to provide reliable lighting controls solutions that save energy and provide comfortable lighting “right out of the box.”

Space types supported:

- Open and private office space
- Architypical retail space types (bigbox, eg)
- Varying ceiling styles
 - A NEMA-G hung-ceiling with accessible plenum and flexible wiring system above false
- Capability to simulate existing building lighting retrofit scenarios
 - Existing ceiling lighting REPLACED with new pendant-hung or recessed lighting system. A smart luminaire with integrated sensor and control package is example. Or recessed lighting with control and sensing at the zone level.
 - For DALI or RS-485, with wired ballast control network
 - Lighting retrofit wireless or powerline control
- Capability to simulate existing recessed (or pendant-hung) luminaire renovation keeping only the fixture body and/or housing.
 - With wired ballast control network
 - With wireless or powerline control

Lighting systems supported

- Overhead fluorescent lighting (recessed or pendant)
- Furniture-based lighting (such as undercabinet LED lights),
- Sensor and controls packages
- Wired or wireless network and lighting control software.
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Instrumentation

Instrumentation will consist of an integrated control and data acquisition system with easily programmable controls capabilities and for comprehensive but flexible data presentation and remote access. Instrumentation should include:

- World class weather station capable of measuring the following:
 - Global and diffuse horizontal illuminance
 - Global and diffuse horizontal irradiance
 - Solar normal pyroheliometer
 - HDR cameras with automated solar shadow

- Illuminance sensing capabilities (from daylight and electric light) on various room surfaces
 - Appropriately spaced and located CMOS cameras to allow real time measurement of luminance of strategically located calibration dots to allow accurate mapping of measured luminance from the CMOS detector to illuminance at point.
 - Calibration dots to be located at all desired illuminance points
 - Illuminance and luminance meters at strategic locations on furniture and desk surfaces.
- Power monitoring:
 - All internal loads
 - Overhead lighting
 - Task lighting,
 - Fan powered terminal units
 - Computers
 - Simulated people,
 - Control and DAQ power if within the cell. Accuracy = 1% of full scale.